AH6CY wraps up his look back at clandestine radios of World War II with the story of the Paraset — a spy radio that's finding new popularity as a QRP transceiver you can still build and use today!

The Paraset: a WWII Spy Radio You Can Build

The Ultimate Retro QRP Transceiver

BY HIROKI KATO,* AH6CY

You may have heard of Noor Inayat Khan, a.k.a. Spy Princess (*Photo A*). She was a young French-Indian woman who volunteered and served as an SOE[1] agent who worked behind the enemy lines in France during World War II. She was captured and tortured by the Nazis and died in a concentration camp[2]. Khan and hundreds of other agents, many of whom were women with multi-lingual talent, were trained by the British spy agency, MI6, and their training included Morse code skill. Khan was reputed to have the best fist among the agents. They were each issued a small (by the standard of the day) three-tube CW transceiver and they either parachuted into the Nazi-occupied area with the transceiver or received the set dropped by a parachute for them. Hence the moniker, the "paraset," although the transceiver was officially called the Whaddon Mark VII (other spy radios were designated as Mark I, II, III etc.). Some parasets were also dropped to and used by various resistance groups in France, Belgium, the Netherlands, and Norway.

The paraset was used to send reports to the receiving station in England about the Nazis' troop and ship movements as well as real-time weather conditions, the latter being of extreme importance in those days as there were no weather satellites. Allied bombers depended on the weather reports gathered by the agents on the ground to determine proper flight paths. Transmitting and receiving frequencies were different; it was always a "split frequency" operation. Agents used their receiving capability to confirm if their transmitted message was received in England by listening to a confirming transmission from England. While two-way communication between two parasets was possible, the radio was not used in that manner.

Unfortunately, only a few of the original parasets survive today. Winston Churchill ordered a complete destruction of this and other spy radios soon after the end of WWII for fear that they may fall into the Soviets' hands as the Cold War began. One of the surviving parasets is on display at the Imperial War Museum in London (*Photo B*). I visited the museum in the spring of 2014 and found this notation next to the radio:

"Olaf Reed-Olsen (Photo C) was a famous MI6 agent who operated in his native Norway, 1943-1944, particularly in the Kristianland area, and reporting on German shipping. He communicated with London using his Mk VII transceiver. He operated three times in Norway before making his final escape to Sweden in December, 1944. (This version) ... is mounted within a suitcase for disguise and portability."

Photo A. "Spy Princess" Noor Inayat Khan. (British National Archives photo)

The schematic seen in *Figure 1* was redrawn by SM7CUZ from the original. The radio works from 3 MHz to 8 MHz, is crystal-controlled and can produce about 5 watts output. It requires 300- to 400-v DC plate voltage to the tubes and 6.3v to the heaters (filaments). Some versions came with an AC power supply and others with a vibrator to be used with a 12-

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e-mail: <hiroki@pacbell.net>

Photo B. One of the few surviving original parasets is on display at Britain's Imperial War Museum. (AH6CY photos, except as noted)

Photo C. British MI6 agent Olaf Reed-Olsen operated in his native Norway from 1943-1944, using a paraset built into a suitcase to communicate with the UK. (British National Archives photo, photographed in the Imperial War Museum by AH6CY)

Photo D. Mike Murphy, WU2D, built this replica paraset and had an extraordinary QSO with it. See text and Photo E for details. (Photo courtesy WU2D)

volt battery. In some cases, the radio was operated with a bicycle generator.

Building Paraset Replicas

Today, there is a group of enthusiast hams in Europe and North America who have replicated the transceiver and operate their replicas from time to time[3]. Among others, I have seen the photos of replicated radios by SM7UC, F4SMX, G3YVF, VE7SL, LA5MT, and WBØLXV. Mike Murphy, WU2D, whose radio appears in *Photo D*, had an extraordinary QSO using his paraset replica. He related the following story to me:

"… [O]n Feb. 27, 2009 … I boldly made a CQ on 3520 kHz at 10:30 p.m. and DL1EV, Bruno, came back from Germany ... We QSO'd for about 20 minutes. It turned out that he was a radio operator in the Wehrmacht in WWII and actually hunted parasets with his DF (direction-finding) van."

DL1EV's QSL card is seen in Photo E.

Building My Own Paraset

When I first learned of the paraset around 2005, it took me no time to decide to build a replica myself. My first homebrew transmitter in 1957, when I was in high school, had a 6V6 final tube. Encountering a radio with this tube was like

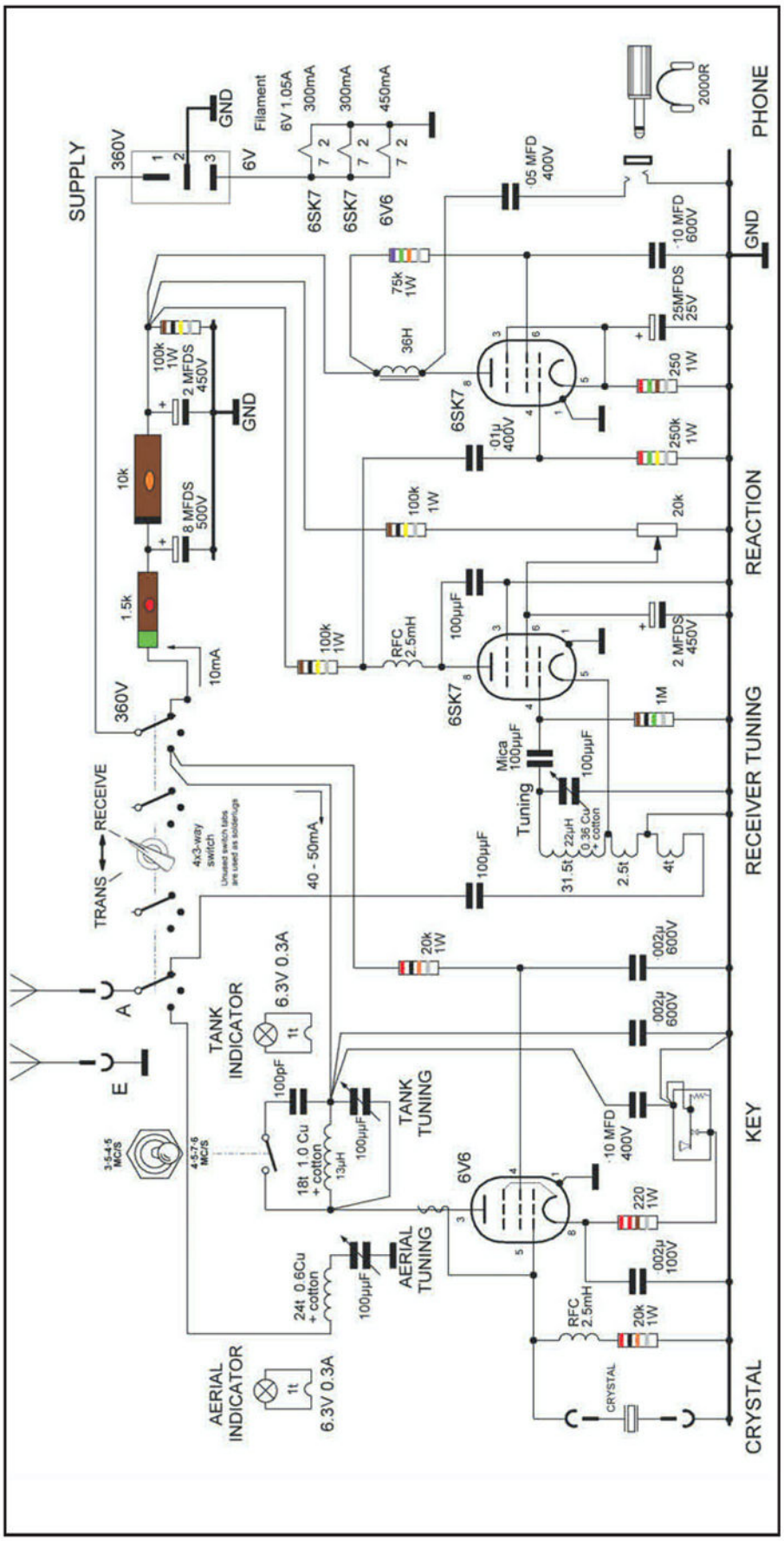

Figure 1. Schematic of the paraset, drawn by SM7CUZ, based on the original paraset owned by Alan Oatley, MØAVN. (Courtesy Johnny Apell, SM7CUZ)

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(from page 3)

15 Years of Ham Radio on the International Space Station

The first amateur radio contacts from the International Space Station (ISS) were made in late 2000, the beginning of a continuous amateur radio presence on the station. A special event to mark the anniversary — a planned slow-scan TV transmission from orbit — was postponed at the last minute, according to the ARRL, due to "complications in planning." At press time in late December, the event was tentatively rescheduled for mid-January.

Yasme Foundation Awards Multiple Grants

The Yasme Foundation announced a dozen grants in late December to support a variety of amateur radio activities, both on and off the air. According to the ARRL, recipients include ARISS, the Amateur Radio on the International Space Station program; the ARRL Teachers Institute; the Reverse Beacon Network; scholarships through the ARRL Foundation and the Foundation for Amateur Radio; the Youngsters on the Air program in Europe, the Northern California DX Foundation's beacon project; the Haiti Amateur Radio Club; 4U1ITU, the amateur station at the International Telecommunication Union headquarters in Genva, Switzerland; the 2018 World Radiosport Team Championship (WRTC); Ethiopian Amateur Radio Society club station ET3AA; the World Wide Radio Operators Foundation and Dokufunk, the Research and Documentation Center for the History of Radio Communications and the Electronic Media in Vienna, Austria. The amounts of the individual grants were not disclosed.

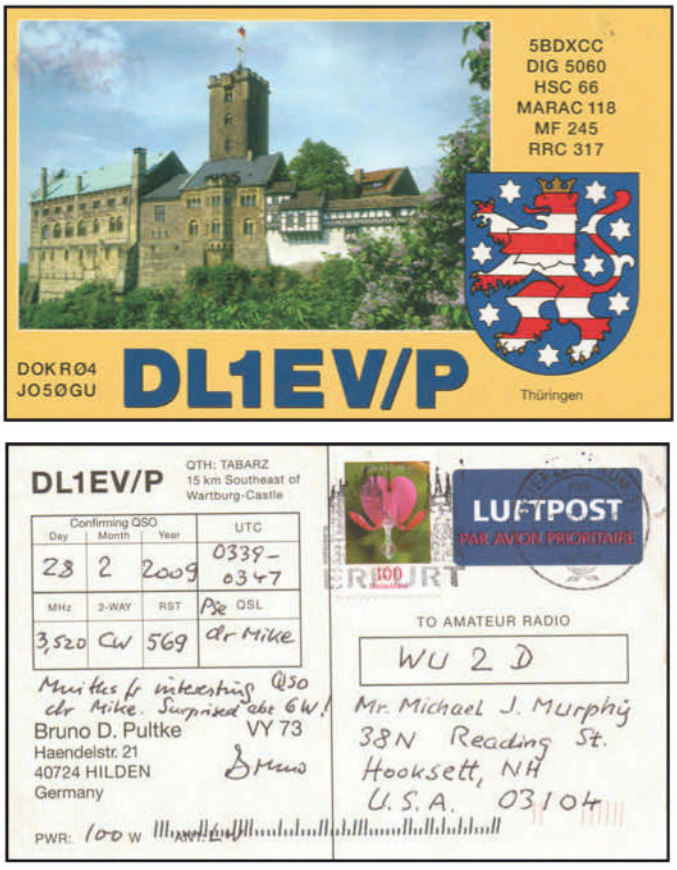

Photo E. WU2D's QSL card for a contact with DL1EV made using his paraset replica. DL1EV told Mike he had been in the German Army during World War II, tasked with tracking down parasets and other clandestine transmitters! (Photos courtesy WU2D)

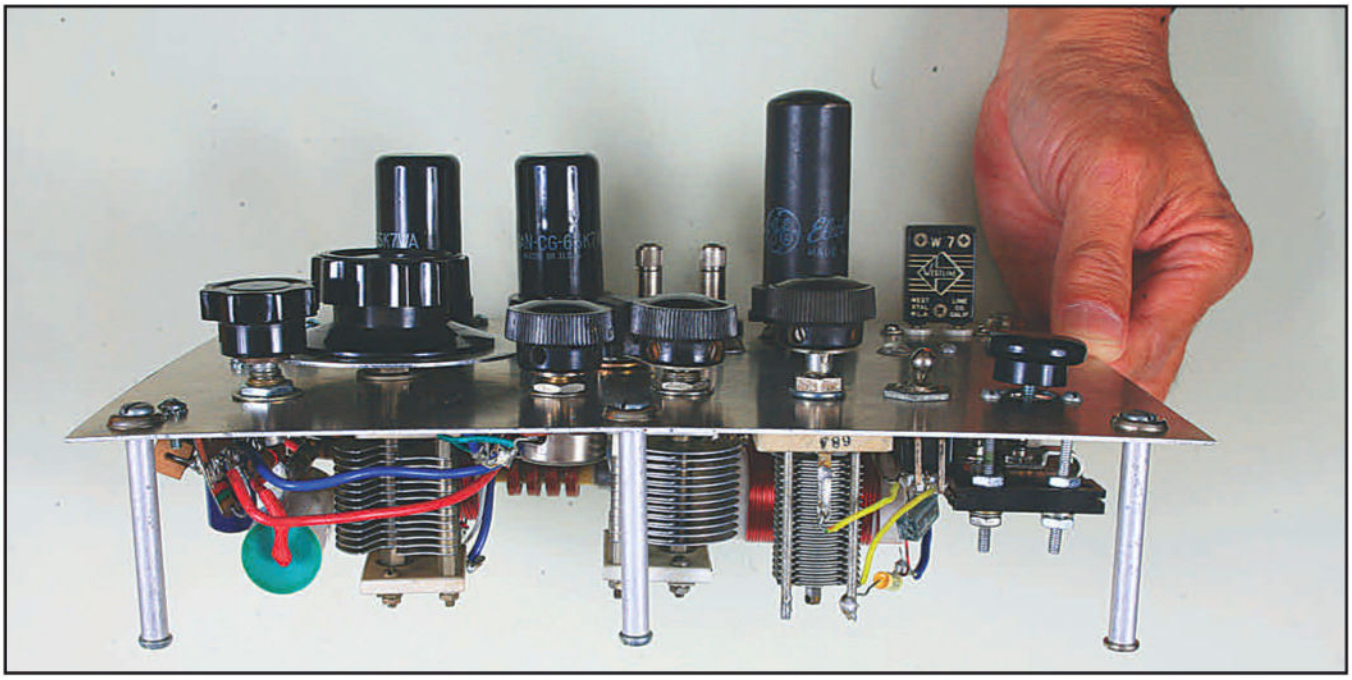

Photo F. The author's replica of the Paraset transceiver. Controls are on the top of the single-piece chassis; all components are on the bottom.

Photo G. The case for the author's paraset replica is an old wooden shoebox he found in an antique shop.

Photo H. The author using his paraset replica on the air.

meeting my first girlfriend again! Two areas of ham radio activities have been my favorites: Restoration of old tube radios and QRP portable operation. This project would combine both areas nicely. Besides, I had most of the key components in my junk box, accumulated over many decades, though they were not necessarily of WWII vintage. It took me a few years of going to ham swap meets and searching on the Internet to locate original or near-original components. In retrospect, though, I can say that if one is seriously interested and is willing to spend time to look, it is not all that difficult to locate vintage components (or reproductions) even today, thanks to the Internet and still-available distributors in the U.S. and Europe.

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My paraset replica (*Photos F and G*) was built into a repurposed wooden shoebox that I found in an antique shop. My power supply is from a repurposed old tube pre-amplifier. All the tubes and other unnecessary parts from the original pre-amp were taken out.

I have used my paraset (*Photo H*) for Straight Key Night a few times. But my fondest experience with it was when I simulated a "real world" clandestine operation. In November 2012, two of my ham friends and I went on a camping and outdoor QRP operating trip to Jalama Beach Park, near Santa Barbara, California. Using a 20-foot-long thin wire flung over nearby bush for an antenna, I called CQ on 7199.7 kHz. W7UDA in Barstow, California, about 200 miles away, came back to me and we had a solid two-way QSO. The distance covered would be more than enough for an SOE agent to send a message from Normandy to the English coast. Of course, no Nazis came looking for me and I'm thankful for my own real "real" world.

[Portions of this article appeared in *Electric Radio*, November 2012 (#282) and March 2013 (#286)]

Update – Another WWII Clandestine Radio

Photo I. Queen Wilhelmina of the Netherlands broadcasts from England on Radio Oranje during World War II. (Dutch National Archives photo)

Photo J. Clandestine radio built during the Nazi occupation of the Netherlands was contained in two tin boxes. (Photos J-L by and courtesy of Dick Lodge)

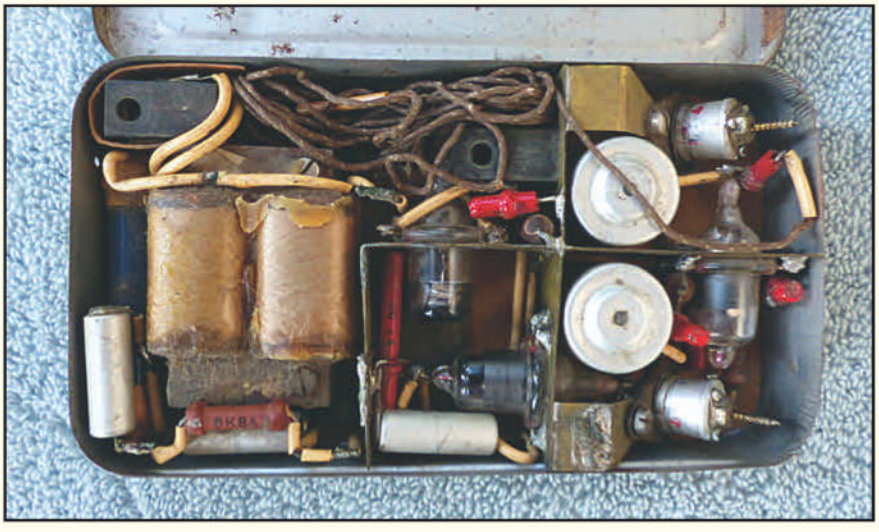

Photo K. The larger of the two tins contained the electronics of the radio itself.

Many readers wrote to me after they read my *CQ* article on the clandestine radios of WWII (July 2015). John Swartz, WA9AQN, told me about a secretly-built radio from the Netherlands he had seen in St. Louis about 15 years ago. John and his wife, a Dutch language translator, ran into Dick and Anja Lodge, a husband-and-wife translator team, at a conference in that city. At one point, their conversation turned to radio, not surprisingly considering John was a ham, whereupon Anja mentioned a radio her parents owned during WWII in the Netherlands. The next day she brought it to show to John.

Anja passed away in 2013, but I have been able to contact her husband Dick and, with his tenacious help, I was able to put together the following story.

The Nazis invaded the Netherlands in 1940 and quickly confiscated radios and prohibited the citizens in the occupied territories from listening to any broadcast from abroad, just as they did in Norway and France. The most anxiously-awaited broadcast for the citizens in Holland was the BBC broadcast in the Dutch language from the exiled Dutch government in London. It was called Radio Oranje ("Orange")[4] and it came on the air for 15 minutes every day at 9 p.m. Not only was Queen Wilhelmina on the air (*Photo I*) for Radio Oranje's first broadcast on July 28, 1940, but she spoke 34 times throughout WWII.

Anja's parents, Ed and Ida Vogel, lived in Eindhoven, the home of the Philips electronic company when the war started. Many residents of that town worked for Philips; in fact her father, a tax department official, was the only man on their

Notes:

1. SOE stands for the Special Operations Executive, a volunteer spy agents group created by the order of Churchill.
2. Sharabani Basu, *Spy Princess: The Life of Noor Inayat Khan,* Omega Publications 2007.
3. See <https://groups.yahoo.com/neo/groups/LesAmisduparaset>
4. Orange is the national color of the Netherlands. The House of Orange-Nassau originated in a small principality of Orange in southern France in the 12th century. It rose to rule the Netherlands and England in the 17th century as protector of the Protestant populace against Catholic Spain. The association of the color orange or the fruit with the royal house of Orange did not start until the 17th century.

Photo L. The headphones and power cord were stored in the smaller tin.

street who did *not* work for the company. Not long after the German occupation began, one of their neighbors, Piet Vennema, who worked for Philips, built and gave a radio contained in two tin boxes to the Vogels (*Photo J*). It is not known if Piet built more radios.

Needless to say, listening to the radio was a highly risky business under the Nazi occupation. Though the Vogels took meticulous care to hide the radio, Anja's oldest sister Janneke, born in 1938, a very young girl at the time, "became curious about her parents' preoccupation with these two tins, and they were concerned that she might say something at the wrong time in the wrong place," as Dick remembers Anja's parents saying. Luckily, that never happened. When Anja's parents passed away, Anja inherited the radio and brought it back to St. Louis where she and her husband Dick lived.

Dick took several photos of the radio for me. The larger tin, a tobacco container, has the three-tube radio built in (*Photo K*) and the small tin houses the headphone and the AC cord (*Photo L*). I cannot clearly identify the acorn tubes but it appears that one of them is a 958 triode or its equivalent. RCA manufactured a number of acorn tubes of similar type in the 1940s. The radio is most likely a regenerative variety.

Are There More Out There?

I cannot help but think that there are more extant forbidden radios from the WWII era. I would love to hear from anyone with any info on or potential leads to such radios. – *AH6CY*

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If building an authentic Paraset replica — as described in the previous article — is above your comfort level, you might want to try building a modern solid-state version. N5IB points the way…

The Tuna Tiny Spy Radio

A Modern Version of the Paraset

BY JIM GIAMMANCO,* N5IB

During World War II, the British SOE (Special Operations Executive) supplied a compact, low-power transmitter/receiver pair to some of the agents operating in occupied Europe. The *Paraset*, as it became known, included a two-tube (6SK7) regenerative receiver tuning from 3.5 Mc to 7.5 Mc, and a single-tube (6V6) crystal-controlled transmitter with an output power of less than 10 watts. A small number survived the war and now fetch astonishing prices on auction sites.

There are a number of hams worldwide who have undertaken to build replicas of the *Paraset* (see previous article). I've gathered enough parts to make one of my own, but suffer from a rare and frequently misdiagnosed malady — TAPS — Tube Anxiety/Procrastination Syndrome. Retreating into my comfort zone, I decided to build a solid-state rig that, while in no way a true replica, would preserve some of the spirit and operating challenge of the original set.

That spirit and operating challenge require that this rig:

1. Incorporate a regenerative receiver
2. Have a tuning range that covers the CW portion of the 40-meter band
3. Use crystal control of the transmitter frequency
4. Have an RF output in the range of 4 to 8 watts
5. Share the same antenna for transmit and receive
6. Include a built-in Morse key
7. Operate from ordinary battery supplies
8. Be housed in something resembling a suitcase
9. Meet current FCC spectral purity rules (a concession to modern times)

Photo A. The Spy Radio, ready for service, complete with accessories required by any British secret agent.

The Receiver

If you are a fan of solid-state regens, you'll recognize the influence of Charles Kitchin, N1TEV, in the modern Spy Radio's receiver section[1]. It's a modification of one of his classic designs[2]. A grounded base RF amplifier stage, with an attenuator at the input, serves to isolate the antenna system from the tank circuit of the JFET detector. The tank is tuned by a combination of fixed and trimmer capacitors, along with a Schottky diode being used as a varactor. The circuit parameters are selected to provide a tuning range of about 150 kHz. That range is about the greatest that can be comfortably tuned by a single-turn potentiometer. For stability, a regulated voltage is supplied to the detector and RF amp stages.

Feedback is supplied by a tickler winding coupled to the tank coil. The amount of feedback, and hence the level of regeneration, is controlled by a throttle capacitor. The interesting wrinkle in this variation on the Kitchin circuit is that the throttle capacitor is once more a combination of fixed and trimmer capacitors, and another Schottky diode varactor. An advantage of the varactor tuning and regeneration controls is that the potentiometers that control the varactors are bypassed for RF,

*n5ib@juno.com
http://n5ib.net/Index.xht

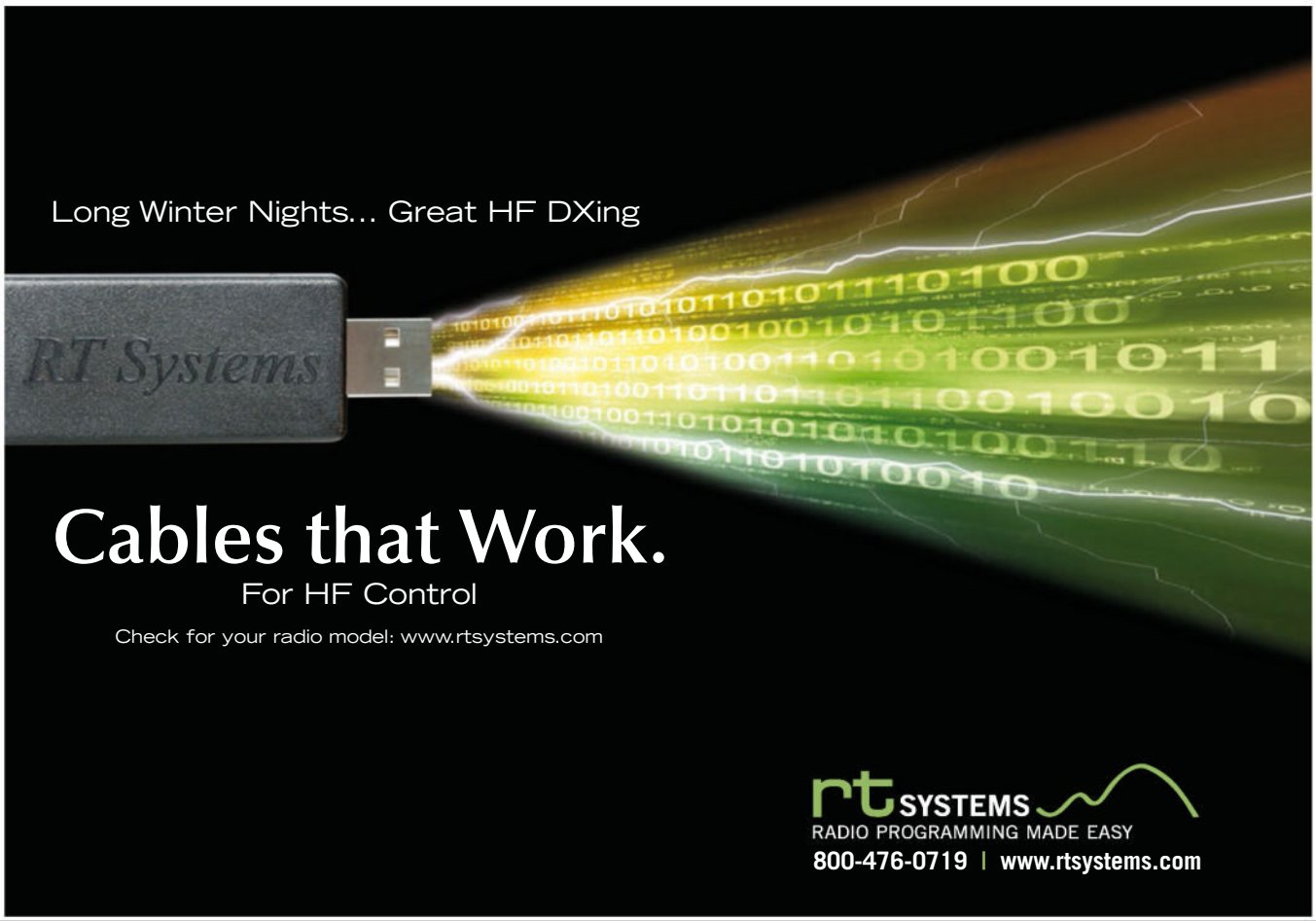

Photo B. Replicas of destination stickers completed the period look of the travel case.

so they are not "RF hot" and hand effects are kept to a minimum.

A few comments are in order about temperature stability. The type-7 mix toroidal core (T68-7) used in the detector's tank circuit has a positive temperature coefficient, meaning the magnetic permeability of the iron powder core, and the coil's inductance, will *increase* as temperature rises. This will cause the received frequency to drift downward. To counteract this effect, a capacitor should be selected that has a negative temperature coefficient, so its capacitance will *decrease* as the temperature rises. Most of the fixed capacitance in the tank circuit is provided by a polystyrene capacitor, which has the desired negative temperature coefficient. The two opposite temperature characteristics partially cancel one another and improve the overall temperature stability of the receiver.

Detected audio is taken from the source circuit of the JFET detector and fed to a one-transistor preamplifier stage. A simple RC low-pass filter rolls off the high-frequency end of the received audio. Extra capacitance can be switched in to the RC filter for CW reception to suppress the high audio frequencies even more. An LM386 integrated circuit audio power amplifier then provides plenty of audio to drive either low-impedance headphones or a decent sized speaker for group listening. Careful attention to decoupling and bypassing around the LM386 keep its mischievous quirks at bay.

Remember that this simple receiver has no automatic gain control (AGC), so the sudden appearance of a very strong signal can, for a headphone-wearing listener, be startling to say the least.

The Transmitter

The transmitter begins with the classic *Tuna Tin 2* circuit[3] from Doug DeMaw, W1FB (SK), partnered with a MOSFET (metal oxide semiconductor, field effect transistor) power amplifier stage patterned after the *Tuna Topper* designed by Chuck Carpenter, W5USJ[4]. The Tuna Tin's Pierce crystal oscillator is followed by a class-C output stage that serves as the driver for the Texas Topper's MOSFET final amplifier. Only a few modifications were needed to join the two into a single unit[5].

Since the Tuna Tin's PA stage was now the driver stage for the N-channel enhancement mode MOSFET final amplifier, the output transformer and low-pass filter of the Tuna Tin were removed and replaced by a broadband, untuned transformer terminated by a low-value load resistor at the gate of the MOSFET. A potentiometer was added to the emitter circuit of the Tuna Tin's output stage in order to control the drive to the final amplifier. A Zener diode regulates the gate bias supply for MOSFET, with a potentiometer for adjustment. The final transistor can get warm, so a small TO-220 style heatsink was used.

A broadband 1:4 impedance-matching transformer couples the PA output to a low-pass filter that incorporates harmonic traps. Spectrum measurements show that harmonic energy is at least 55 dB below the fundamental, exceeding current FCC requirements. It was easy to adjust the drive and bias for 4 watts output. Current drawn from a 12.5-V supply was about 630 mA. Measurements showed a gain of about 15 to 16 dB, and an efficiency of about 50%.

To assist when using the transmitter with a separate receiver, a spotting mode was added. A SPST pushbutton switch applies power to the oscillator stage only, allowing zero-beating a receiver to the crystal frequency. A nice selection of 40-meter crystals in HC-49 holders was obtained from QRPme[6]. The small modern crystals were installed into old surplus FT-241-A and FT-243 holders to preserve a vintage appearance. An authentic FT-243 crystal socket was donated by Darron Sanchez, WA5TCZ.

Changeover from receive to transmit mode is accomplished by a multi-pole rotary switch. The transmitter is powered off during receive periods, and the receiver is powered off during transmit intervals. During receive, the SPOT button will energize the crystal oscillator stage to allow locating the crystal frequency. The attenuator has to be turned fully up, and the regeneration advanced to maximum to keep from blocking the receiver with the oscillator's signal.

The Enclosure

The *Paraset* and other clandestine radio sets of the era were often built into ordinary looking suitcases, so of course this modern creation needed to mimic that look (*Photo A*). A browse at one of the big box hobby stores uncovered a small, hinged, unfinished wooden box with a handle, no doubt meant to become a purse or makeup case. A search of the web turned up several sites that post extensive collections of images of those vintage "travel stickers" that were often plastered all over travelers' luggage. A selection of stickers representing 1930s/40s locales that were notorious "nests of spies and intrigue" was reduced in size and printed on water transfer decal paper with a color laser printer. After the box received a couple of coats of wood finish, the decals were applied (*Photo B*), and then several more coats of clear finish were added.

A control panel was made from double-sided, copper-clad circuit board material (*Photo C*). The controls and connectors were mounted onto the panel, and the receive and transmit circuit boards were mounted beneath the panel (*Photo D*). The inside of the box was lined with aluminum foil duct sealing tape to provide some RF shielding. The same decal transfer paper was used to create the labels for the panel controls and connectors.

At this point, an undercurrent of whimsy crept in. The panel was labeled using the British terms like *REACTION* instead of *REGENERATION, AERIAL* in-

Photo C. Control Panel of the completed Spy Radio.

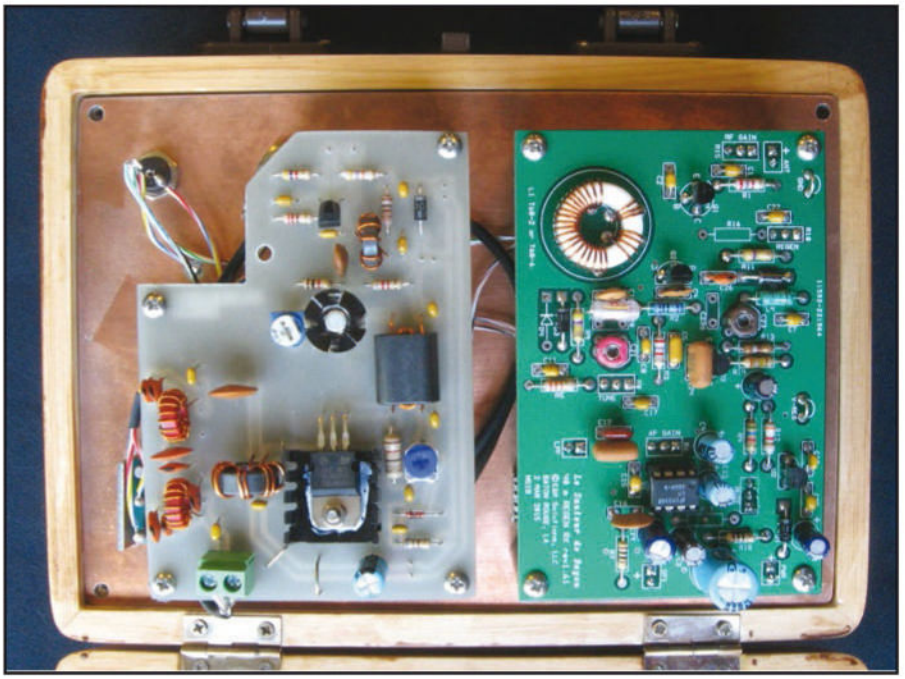

Photo D. Transmitter and receiver circuit boards mounted beneath the control panel.

Photo E. Whimsical serial number and user information.

Photo F. A detailed view of the Morse key.

Photo G. The switch mechanism is attached to the underside of the panel with the actuator just protruding above the top surface.

stead of *ANTENNA*, and so on. By this time the whimsy was out of control and the serial number decal and customer service label were added (*Photo E*).

The Morse Key

A straight key was fashioned from a Microswitch® and a strip of thin (.031-inch) PCB material. It's mounted directly on the control panel of the radio (*Photo F*). The switch mechanism is attached to the underside of the panel with the actuator just protruding above the top surface (*Photo G*). Thin PCB stock has just about the right springiness for the key arm. The big box hobby store provided a miniature wooden ball and disk to complete the vintage "Navy knob" look and feel. The key works well enough that hand-sent code is usually correctly decoded by the Reverse Beacon Network's skimmers.

Operations

First contact was a local one with John Stevens, K5JS. To date, with 4 watts output, 28 states have been worked, with reports ranging from 339 to 599. One early highlight was working Steve Robertson, KE4OH, in Knoxville, Tennessee, a distance roughly the same as the 560 miles from London to Kristiansand, Norway — the path routinely spanned by a real *Paraset* covertly operated by Oluf Olsen during WWII[7].

Of course, it was a challenge at first to get re-educated in the subtle art of tuning a regen receiver and operating a separate transmitter that lacked QSK (break-in) or even a sidetone. But memories of Novice days bubbled back to the surface and before long, even quick, contest-style contacts were being made. After a few minutes of warmup, drift was not troublesome, and contacts lasting 20 or 30 minutes were completed.

As with most regens, the sensitivity is very good. At night, when signals are strong, the input attenuation is generally turned to 30 to 50 percent. The varactor throttle capacitor circuit brings the detector smoothly into and out of oscillation, without thumps or plops, and with little or no hysteresis. For SSB reception, advancing the regeneration control usually helps with audio quality. Naturally USB or LSB doesn't matter; just tune to the correct side of zero beat. Since a CW signal can be tuned on either side of zero beat, often an interfering signal can be suppressed by tuning to the side farthest away from the interference.

Much more detail, including schematics, parts lists, printed circuit board images, building tips, and photographs can be found on the web at: <http://n5ib.net/Index.xht>. Modification of both the receiver and transmitter for use on 80, 60, or 30 meters ought not be very difficult. Crystals for each of those bands, and yes, even 60 meters[8], can be found. Printed circuit boards for the receiver (but not the transmitter) are available from the author.

Notes:

1. 40-meter regenerative receiver: <http://bit.ly/1N6azaL>
2. Kitchin, Charles, *High Performance Regenerative Receiver Design, QEX*, Nov/Dec 1998, p. 24
3. Hare, Ed, *The Tuna Tin 2 Today, QST*, March 2000, p. 37
4. Texas Topper from QRPme: <http://www.qrpme.com/?p=product&id=TEX>
5. Companion Transmitter for 40 meters Regen Rx: <http://bit.ly/1NsXE6s>
6. Crystal assortment from QRPme: <http://qrpme.com/?p=product&id=X40>
7. Olsen, Oluf Reed, *Two Eggs on My Plate*, F. H. Lyon trans., Fontana Books, 1972
8. 60-meter crystals available from: <http://bit.ly/1NJZTnK>